Project Title

Scale-Up and Demonstration of Fly Ash Ozonation Technology

First Quarterly Technical Report
Reporting Period: Inception through June 2004

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DISCLAIMER

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ABSTRACT

This is the first Quarterly report under DOE Cooperative Agreement No.: DE-FC26-03NT41730. Due a number of circumstances, mostly associated with subcontractor agreements, the actual beginning of the project has been delayed from its original award date of March 5, 2003. DOE's Project Manager has been kept informed (verbally) by PPL's Project Manager throughout this period.

Because of this delay, this is the first quarterly report and it refers to the time period from the official project authorization date to June 2004. In addition, this report is essentially a review of the project objectives and approach, with a brief update on the recent "kick-off" and site visit activities in the Results and Discussion section.

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INTRODUCTION

Objectives

PPL has lost concrete marketability for much of its ash from the Montour power station due to high carbon content. The objectives of the project are: (1) to demonstrate ash ozonation technology at a utility site, with minimum modification to existing plant equipment and operations; (2) to confirm the process effectiveness through a complete battery of technology performance and concrete quality tests; and (3) to develop a plan for effective implementation at the PPL Montour station and for technology transfer to other U.S. coal-fired plants.

EXECUTIVE SUMMARY

Scope of Work

Based on the results of pilot testing performed during the Spring/Summer of 2002 at the FLSmidth test facility, the project team determined that air merge blending is the technology of choice for fluidization/ozonation of fly ash. In Task 1 of the project, the technology will be deployed and tested at PPL's Montour Steam Electric Station, where it will be integrated with existing ash handling systems. In Task 2 technical and economic analyses will be conducted for a full-scale, commercial design of the technology. Task 3 is proposed as a "documentation" task and will produce a Final Report to DOE. These tasks are described below in more detail.

In this project, PPL will supply a continuous stream of the high-carbon problem ash, as well as ash handling equipment at the station (e.g. silos, fans, etc.). Ash from other (non-Montour) sources will also be obtained and tested to evaluate the influence of different ash parameters on the effectiveness of the ozonation technology. Wedeco will supply a new SMA50 ozone generator capable of treating large quantities of ash, which will be subsequently tested and collected for off-site concrete testing by CPM. A matrix of contacting conditions and carbon/ozone stoichiometries will be tested and the results compared. Supporting analyses of the ash will be carried out at the Brown University research laboratories. A plan will be developed for implementation of the optimal process at Montour and for technology transfer to other U.S. generating plants. Finally, design guidelines will be developed to allow for an effective "jump" into commercial development.

EXPERIMENTAL

Tasks Description

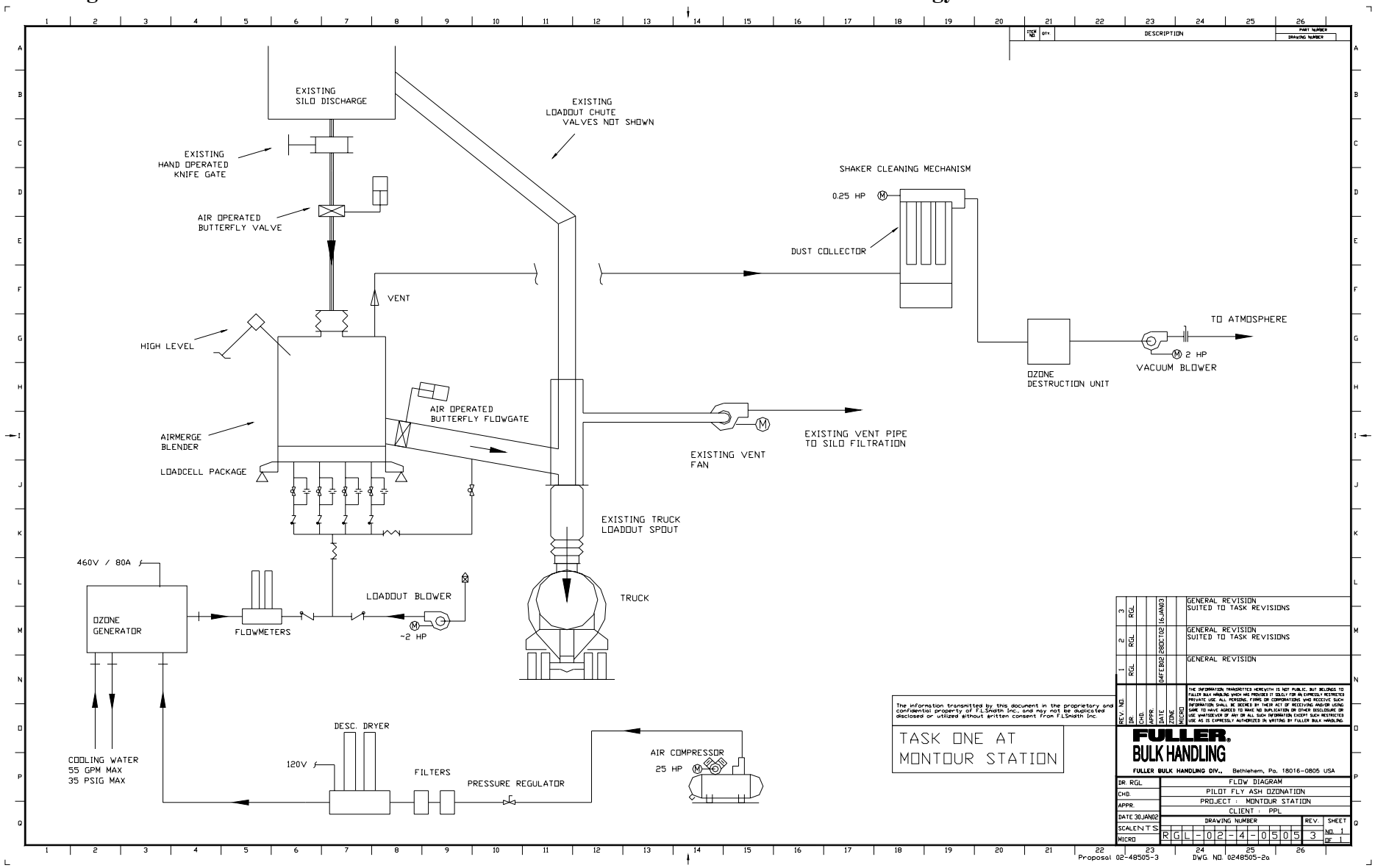
The proposed scope of work will be broken down into the following major tasks

TASK 1 – Design/Deploy/Test semi-commercial fluid bed system at Montour Station

Objective – Conduct semi-commercial scale test of fluidization/ozonation of fly ash at PPL's Montour Station using FLSmidth's Airmerge™ blender and Wedeco's ozonation technologies. Building upon previous tests and development by the project team, FLSmidth will design and fabricate a 42" diameter Airmerge™ batch blender for gas/solids contacting. Wedeco will supply a new SMA50 ozone generator capable of producing 100 lb/day of ozone operating on air. The system will be integrated with existing ash handling systems at Fly Ash Storage Silo #1 at PPL's Montour Station, as illustrated in Figure 1. Off-gases will be pre-filtered and sent to an ozone destruct unit prior to discharge to atmosphere. FLSmidth will complete the installation approximately 5 months from the start of the project.

Six fly ashes of varying characteristics will be tested in the system to develop a range of system operating parameters. The installed system will accept ash from the silo, "ozonate" the ash in batches, and loadout the ash to tanker trucks through an existing dry loadout spout. FLSmidth is investigating alternate use of an existing blowback line to the silo for discharging spent ash. Streamlined material flow will allow for ash throughput of about 10 tons/day. Testing is anticipated to last approximately four months.

Figure 1 - Task 1 Semi-commercial scale installation of fluidization/ozonation technology at Montour



The following activities, or subtasks, will be conducted in this task.

- Design and fabricate 42-inch Airmerge™ blender and SMA50 ozone generator.
- Prepare test matrix.
- Deploy fluidization/ozone generator system.
- Interface with Montour ash handling systems (storage silos, dry ash loadout, etc.)
- Conduct parametric tests
    - Operating parameters
        - *bed height,*
        - *fluidization/aeration velocities*
        - *vibratory fluidization enhancement*
        - *raw ash quality (different sources and carbon content)*
        - *ozone reaction stoichiometry (gm-ozone/kg-ash)*
- Conduct ash and concrete analyses (foam index, mortar air-entraining tests, petrography, trial batches for short and extended mixing times)
- Results documentation
- Reporting to DOE

TASK 2 – Design Full Scale-up for Montour Station and Development of Generic Design Guidelines

Objective – Develop design modifications for the full scale-up of the ash fluidization/ozonation system based on overall performance considerations from Task 1. This will serve to demonstrate low-cost retrofit potential to existing systems at normal operating conditions. Develop generic design guidelines addressing technical and cost considerations, for commercializing the technology. The following activities, or subtasks, will be conducted in this task.

- Design modifications for existing systems
- Develop design guidelines for wide-applicability ozonation systems
- Cost/Economic analyses
- Results documentation
- Reporting to DOE

TASK 3 – Final Report

Objective – Provide full documentation of project results and develop design guidelines, cost estimates commercialization potential for the technology. This will include:

- Design criteria
- Performance expectations
- Cost
- Applicability
- Deployment and operation

RESULTS AND DISCUSSION

As stated up front, due to several circumstances, the actual project scope of work has only recently gotten underway. As a result, this first Quarterly report includes mostly background information, as opposed to the "traditional" status update content of future Quarterly reports.

However, as was communicated to the DOE Project manager, project activities have begun recently and are briefly summarized here.

Montour Plant Site Visit

On May 13, 2004, FLSmidth conducted a site visit at PPL's Montour Dry Fly Ash Area to get a detailed engineering perspective, with respect to both design and safety. FLSmidth left with a clearer picture of requirements and had some important questions answered.

Following is a summary of notes and issues from the site visit.

- Purpose for this visit was to get a general "lay of the land" from a detailed engineering perspective, with respect to both design and safety.

- PPL has a first aid team; in case of accident, the control room is notified via one of the telephones located around the silo area. FLS will develop a safety program for this project and testing. Due to the use of O3 in the test work, any personnel that need access to the loading floor area will need to be safety trained.

- The Montour Plant Engineer contact was identified.

- EPRI will have a project manager assigned.

- The use of an eductor to transfer material out of the blender was discussed in lieu of dry unloading spout to bulk truck.

- Permits need to be pursued - both building and DEP air quality. This will be done by PPL.

- Inspection of the Silo 1 loading floor and surrounding areas. Additional measurements and equipment locations were discussed. Location of instrument air supply and possible convey line routing for the eductor concept was done. Room and door openings were measured for use in determination of ventilation requirements. The cooling water supply routing was also examined, as well as the disposal of cooling water. General locations of the O3 generator container and compressor/air treatment skid were reviewed.

- The cooling water line is to be supplied from the existing truck spray supply. The cooling water requirement for the O3 generator is 50 gpm. The tubing should be adequate to deliver the required flow.

- The truck wash for Silo 1 will have to be deactivated during the operation of the O3 generator.

- The discharge stream from the O3 generator is to be routed to the drain pits for the truck wash and is presumably capable of handling the 50 gpm flow.

- Inquired about the possible use of the lime convey line instead of the ash line for tie-in of eductor system.

- Calculations will be done on the ash line at this point, and will be the line of choice for use with the O3 Blender project. If the ash line is not suitable, then the lime line may be further investigated.

- Action: FLS to perform pipeline sizing calculations and look at eductor capability.

- Instrument air for actuation of solenoids is required. A plant air supply is located a few feet from the blender proposed location.

- Location of the blender, blender dust collector, fan, and O3 destruct unit is to be on the Silo 1 loading floor. Specific location was not identified, but will be very close to the blender. Discharge of fan is to be outside the silo building.

- Drawings of the Silo 1/2 area (overall plans, plus the loading floor details) are to be provided by PPL to FLS to assist in the installation drawings and instructions to the installation contractor.

“Kick-off” Conference Call

A project "kick-off" conference call was held on June 7, 2004 conference call among project partners.

Summary of action items/issues from the conference call:

- EPRI/Brown/EES to develop plan for providing on-site direction of field parametric testing.
- PPL to provide technician to conduct Foam Index Tests
- FLSmidth to provide Wedeco a description of how O3 generator will be operated (e.g., min/max conditions)
- PPL to confirm water supply can handle ~60 gpm during operation of O3 generator.
- FLSmidth to provide PPL estimate of instrument air demand.
- FLSmidth to provide PPL information on emissions/air pollution control devices to determine whether an air permit is required.

Another project meeting conference call is planned for mid-July to address the outstanding items to date as well as to finalize project management, schedule and start of onsite activities.

CONCLUSIONS

No conclusions for this reporting period.

REFERENCES

None for this reporting period.

LIST OF ACRONYMS AND ABBREVIATIONS

DOE	Department of Energy
ESP	Electrostatic precipitator
FGD	Flue gas desulfurization
ID Fan	Induced draft fan
cfm	Cubic feet per minute
kW	Kilowatt
MW	Megawatt
NETL	National Energy Technology Laboratory
O&M	Operating and Maintenance
PC	Pulverized coal
PRB	Powder River Basin
FBH	Fuller Bulk Handling Division
PPL	PPL Generation, LLC
EPRI	Electric Power Research Institute
EES	Energy and Environmental Strategies